

REMARKS

Claims 1-19 are pending in the application. Claims 20-22 are withdrawn.

Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo et al. (6,788,661, hereinafter "Ylitalo") in view of Boariu et al. (6,865,237, hereinafter "Boariu") or Dabak (6,594,473, hereinafter "Dabak").

Claims 9, 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo in view of Beven et al. (6,891,897, hereinafter "Beven et al.>").

Each of the various rejections and objections are overcome by amendments that are made to the specification, drawing, and/or claims, as well as, or in the alternative, by various arguments that are presented.

Any amendments to any claim for reasons other than as expressly recited herein as being for the purpose of distinguishing such claim from known prior art are not being made with an intent to change in any way the literal scope of such claims or the range of equivalents for such claims. They are being made simply to present language that is better in conformance with the form requirements of Title 35 of the United States Code or is simply clearer and easier to understand than the originally presented language. Any amendments to any claim expressly made in order to distinguish such claim from known prior art are being made only with an intent to change the literal scope of such claim in the most minimal way, i.e., to just avoid the prior art in a way that leaves the claim novel and not obvious in view of the cited prior art, and no equivalent of any subject matter remaining in the claim is intended to be surrendered.

Also, since a dependent claim inherently includes the recitations of the claim or chain of claims from which it depends, it is submitted that the scope and content of any dependent claims that have been herein rewritten in independent form is exactly the same as the scope and content of those claims prior to having been rewritten in independent form. That is, although by convention such rewritten claims are labeled herein as having been "amended," it is submitted that only the format, and not the content, of these claims has been changed. This is true whether a dependent claim has been rewritten to expressly include the limitations of those claims on which it formerly depended or whether an independent claim has been rewriting to include the limitations of claims that previously depended from it. Thus, by such rewriting no equivalent of any subject matter of the original dependent claim is intended to be surrendered. If the Examiner is of a different view, he is respectfully requested to so indicate.

Rejection Under 35 U.S.C. 103(a)

Claims 1-19

Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo et al. in view of Boariu or Dabak. The rejection is traversed.

Applicant's independent claim 1 recites:

"A method for use in a system adapted to transmit at least four series of transmit sequences over at least four transmit antennas, the method comprising the step of: space-time coding at least two pairs of symbol sub-streams, each of the pairs of symbol sub-streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams; wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair."

Applicant maintains that there is sufficient specificity with respect to the transmit-sequence chains of the method of claim 1 to overcome Ylitalo, Dabak, and Boariu, alone or in combination. As claimed in Applicant's claim 1, at least two pairs of symbol sub-streams are space-time coded where each of the pairs of symbol sub-streams is coded to form a respective pair of transmit-sequence chains. As such, although specific matrices are not claimed in Applicant's claim 1, Applicant respectfully asserts that the referenced portions Applicant's claim 1 identify at least four transmit-sequence chains. Furthermore, Applicant's claim 1 further defines characteristics of each of the transmit-sequence chains that are not taught or suggested in Ylitalo, Dabak, and Boariu, alone or in combination.

Specifically, as claimed in Applicant's claim 1, each transmit sequence of a particular transmit sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair. As such, although specific matrices are not claimed in Applicant's claim 1, Applicant respectfully submits that Applicant's claim 1 sufficiently specifies characteristics of transmit-sequence chains that are completely different

from any transmit sequence chain or associated matrix characteristics taught in Ylitalo, Dabak, and Boariu, alone or in combination.

As admitted by the Examiner, Ylitalo discloses two symbol sub-streams and two antennas. Ylitalo fails to teach or suggest at least two pairs of symbol sub-streams, as claimed in Applicant's claim 1. In the Office Action, even though Ylitalo fails to teach at least two pairs of symbols sub-streams, the Examiner asserts that Ylitalo discloses "each of the pairs of symbol sub-streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams" and "wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair." Applicant respectfully submits, however, that since Ylitalo fails to teach or suggest at least two pairs of symbol sub-streams, Ylitalo simply cannot teach or suggest these limitations of Applicant's claim 1.

Since Ylitalo fails to teach or suggest at least two pairs of symbol sub-streams, the Examiner asserts that Ylitalo discloses that additional transmit diversity may be obtained by increasing the number of antennas, using this as a motivation for citing Dabak. The Examiner then cites Dabak, asserting that Dabak discloses a wireless communication system comprising a space-time encoder adapted to space-time code at least two pairs of symbol sub-streams for transmission over at least four transmit antennas.

In other words, the Examiner impermissibly relies upon Dabak to attempt to expand the scope of the teachings of Ylitalo to cover Applicant's claim 1. Specifically, in the Office Action, the Examiner seems to imply that if one pair of symbol sub-streams (and the associated transmit sequence chains) of Ylitalo meet the limitations of Applicant's invention, then adding another pair of symbol sub-streams to the system (even though there is not teaching for another pair of symbol sub-streams) automatically results in a system in which both pairs of symbol sub-streams (and the associated transmit sequence chains) would also meet the relevant limitations of Applicant's invention. Applicant respectfully disagrees.

Since Ylitalo is devoid of any teaching or suggestion of how such a system including two pairs of symbol sub-streams might operate, the Examiner's conclusion that such a system of two

pairs of symbol sub-streams would be a system in accordance with Applicant's claim 1 (i.e., a system in which each of the pairs of symbol sub-streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams and wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant's claim 1) is not based on any actual teaching of Ylitalo.

Rather, the teachings of Ylitalo merely describe a system in which there is one pair of symbol sub-streams. At most, Ylitalo merely mentions that additional transmit antennas may be used. Ylitalo, however, clearly does not specify any details of symbol sub-stream pairs or transmit sequence chains in a system in which there are two pairs of symbol sub-streams. Accordingly, since Ylitalo teaches one symbol sub-stream, and since the Examiner's arguments with respect to the teachings of Ylitalo have no basis in the actual teachings of Ylitalo, Applicant respectfully submits that Ylitalo fails to teach or suggest that each of the pairs of symbol sub-streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams and wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair. As such, the Examiner must rely on another reference in combination with Ylitalo to attempt to show Applicant's claim 1.

In the Office Action, the Examiner relies on Dabak for teaching a portion of Applicant's claim 1. However, as described herein, the Examiner merely relies on Dabak for teaching two pairs of symbol sub-streams. Although the Examiner does not rely on Dabak for teaching those limitations which the Examiner asserts are taught by Ylitalo, Applicant respectfully submits that Dabak fails to bridge the substantial gap between Ylitalo and Applicant's claim 1. Namely, like Ylitalo, Dabak also fails to teach or suggest that each of the pairs of symbol sub-streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time

coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams and wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant's claim 1.

Although Dabak discloses four transmit antennas, Dabak does not teach or suggest two pairs of symbol sub-streams where each of the pairs of symbol sub-streams is space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams and wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant's claim 1.

Rather, as depicted in Figure 4 of Dabak, Dabak discloses a system having one pair of symbol sub-streams, where S1 may correspond to one symbol sub-stream and S2 may correspond to another symbol sub-stream. As described in Dabak, W1 and W2 are merely weighting functions, not symbols of symbol sub-streams. As such, since Figure 4 of Dabak merely teaches one pair of symbol sub-streams, Figure 4 of Dabak simply cannot teach or suggest that each of the pairs of symbol sub-streams is space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams, as claimed in Applicant's claim 1.

Similarly, Figure 4 of Dabak fails to teach or suggest that each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair. Rather, as depicted in Figure 4 of Dabak, each of the transmit sequence chains includes either symbols of sub-streams or complex conjugates of symbols of sub-streams, but not both. For example, the first transmit sequence of

Figure 4 of Dabak (associated with AT1) is a function of $W1S1$ and $W1S2$, i.e., a function only of symbols $S1$ and $S2$. Similarly, the second transmit sequence of Figure 4 of Dabak (associated with AT2) is a function of $W1(-S2^*)$ and $W1S1^*$, i.e., a function only of complex conjugates of symbols $S1$ and $S2$.

Furthermore, although Figure 7 of Dabak includes four symbol sub-streams (i.e., $S1$, $S2$, $S3$, and $S4$), Figure 7 of Dabak fails to teach or suggest that the space-time coding is performed such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams. Rather, as depicted in Figure 7 of Dabak, each of the four transmit sequence chains associated with antennas A80 is a function of symbols of all four symbol sub-streams (i.e., $S1$, $S2$, $S3$, and $S4$). For example, the first transmit sequence chain is a function of $S1$, $S2$, $S3$, and $S4$. In other words, each of the transmit sequence chains of Figure 7 of Dabak is a function of all four symbol sub-streams $S1$, $S2$, $S3$, and $S4$, the second transmit sequence chain is a function of $S1$, $S2$, $S3$, and $S4$, and so on. Moreover, as depicted in Figure 7 of Dabak, each of the transmit sequence chains is devoid of any complex conjugates. Therefore, Figure 7 of Dabak also fails to teach or suggest that each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant's claim 1.

Similarly, although Figure 6 of Dabak includes four symbol sub-streams (i.e., $S1$, $S2$, $S3$, and $S4$), Figure 6 of Dabak fails to teach or suggest that each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant's claim 1. Rather, similar to Figure 7 of Dabak described above, as depicted in Figure 6 of Dabak each of the transmit sequence chains is devoid of any complex conjugates.

As such, for at least these reasons, Dabak fails to teach or suggest at least the limitations of "each of the pairs of symbol sub-streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams" and

“wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair,” as claimed in Applicant’s claim 1.

As such, for at least the reasons discussed above, it is clear that even if the Examiner relied on Dabak for teaching those limitations which the Examiner asserts are taught by Ylitalo, the combination of Ylitalo and Dabak would still fail to teach or suggest that each of the pairs of symbol sub-streams being space-time coded to form a respective pair of the transmit-sequence chains, the space-time coding being such that at least one of the formed pairs of the transmit-sequence chains is a function of symbols of the respective pair of symbol sub-streams and not a function of the symbols of the other pair of symbol sub-streams and wherein each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant’s claim 1. Therefore, Ylitalo and Dabak, alone or in combination, fail to teach or suggest Applicant’s claim 1, as a whole.

Furthermore, Boariu fails to bridge the substantial gap as between Ylitalo and Dabak and Applicant’s claim 1. Although Boariu discloses numerous symbol sub-streams, Boariu fails to teach or suggest at least the limitation that each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant’s claim 1.

Specifically, the transmit sequence matrices depicted and described in Figures 4 and 5 of Boariu fail to teach or suggest that each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant’s claim 1.

Similarly, transmit sequence matrices depicted and described in the specification of Boariu fail to teach or suggest that each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the

respective symbol sub-stream pair, as claimed in Applicant's claim 1. For example, the transmit sequences depicted in Equation 13 of Boariu include either symbols of sub-streams or complex conjugates of symbols of sub-streams, but not both. For example, the first transmit sequence of Equation 13 is S_1, S_2, S_1, S_2 and the second transmit sequence of Equation 13 is $-S_2^*, S_1^*, -S_2^*, S_1^*$. In other words, the transmit sequences are either symbols of sub-streams or complex conjugates of symbols of sub-streams, but not both. Therefore, Boariu fails to teach or suggest that each transmit sequence of a particular transmit-sequence chain is a function of 1) a symbol of one of the symbol sub-streams of the respective symbol sub-stream pair and 2) a complex conjugate of a symbol of the other symbol sub-stream of the respective symbol sub-stream pair, as claimed in Applicant's claim 1.

The test under 35 U.S.C. §103 is not whether an improvement or a use set forth in a patent would have been obvious or non-obvious; rather the test is whether the claimed invention, considered as a whole, would have been obvious. Thus, it is impermissible to focus either on the "gist" or "core" of the invention. Moreover, the invention as a whole is not restricted to the specific subject matter claimed, but also embraces its properties and the problem it solves. Ylitalo and Barak or Boariu, alone or in combination, fail to teach or suggest Applicant's claim 1, as a whole.

As such, independent claim 1 is patentable over Ylitalo in view of Boariu or Dabak under 35 U.S.C. 103(a). Furthermore, Independent claim 10 recites relevant limitations similar to those recited in independent claim 1. Accordingly, for at least the same reasons discussed above, Applicant submits that independent claim 10 is also non-obvious and patentable over Ylitalo in view of Boariu or Dabak under 35 U.S.C. §103. Furthermore claims 2-9 and 11-19 depend directly or indirectly from independent claims 1 and 10 while adding additional elements. Therefore, these dependent claims also are non-obvious and patentable over Ylitalo in view of Boariu or Dabak under 35 U.S.C. §103 for at least the same reasons discussed above in regards to independent claims 1 and 10.

Therefore, the rejection should be withdrawn.

Claims 9, 15-16

Claims 9, 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ylitalo in view of Beven et al. (6,891,897, hereinafter "Beven et al."). The rejection is traversed.

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Each ground of rejection applies only to dependent claims, and each is predicated on the validity of the rejection under 35 U.S.C. 103 given Ylitalo. Since the rejection under 35 U.S.C. 103 given Ylitalo has been overcome, as described hereinabove, and there is no argument put forth by the Office Action that Beven supplies that which is missing from Ylitalo render the independent claims obvious, these grounds of rejection cannot be maintained.

Therefore, the rejection should be withdrawn.

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Conclusion

It is respectfully submitted that the Office Action's rejections have been overcome and that this application is now in condition for allowance. Reconsideration and allowance are, therefore, respectfully solicited.

If, however, the Examiner still believes that there are unresolved issues, the Examiner is invited to call Eamon Wall at (732) 530-9404 so that arrangements may be made to discuss and resolve any such issues.

Respectfully submitted,

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